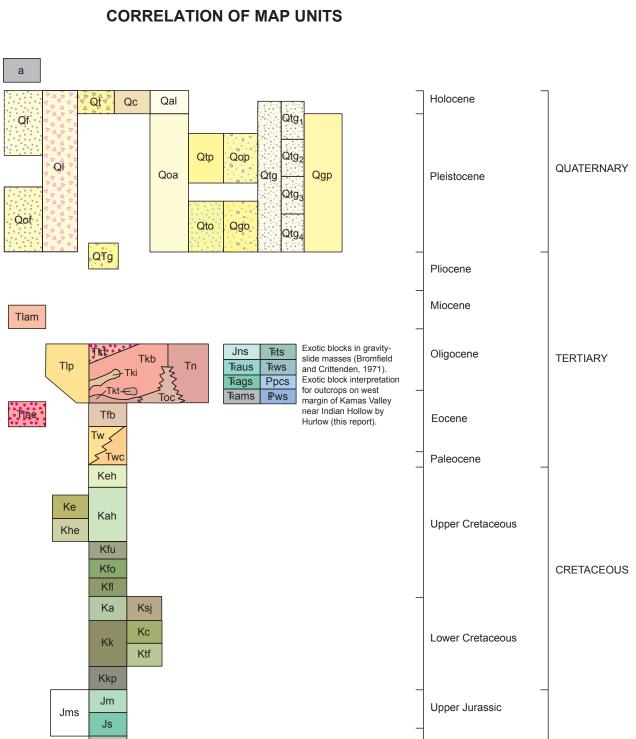
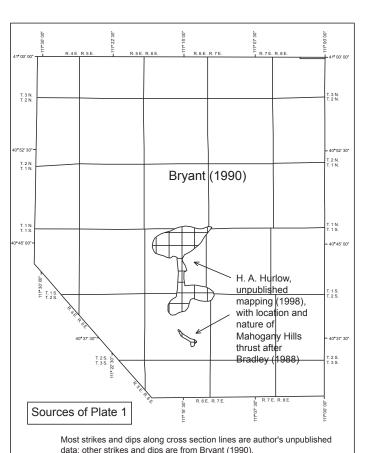
## **DESCRIPTION OF MAP UNITS**

Modified from Bryant (1990)

(Isotopic ages have been recalculated from decay constants accepted by the U.S. Geological Survey)



- Jp JURASSIC Middle Jurassic Jtw Jtrs Lower Jurassic Jn ₹au Upper Triassic Ћа ₹ag **Tam TRIASSIC** Lower Triassic Τ̄t Ŧw Ppc **PERMIAN** ₽w ₽m PENNSYLVANIAN Middle Pennsylvanian Lower Pennsylvanian Upper Mississippian Mh **MISSISSIPPIAN** Lower Mississippian **DEVONIAN CAMBRIAN** 
  - Late Cretaceous fossil ages cited in Description of Map Units (Palmer and Geissman, 1999) Picks (Ma) - 65.0 Maastrichtian Campanian - 83.5 Santonian 85.8 Coniacian 89.0 Turonian - 93.5□ Cenomanian 99.0



- Artificial fill (Historical) Boulder to pebble gravel, sand and silt used as fill in dams. Undifferentiated Quaternary deposits - Shown only on cross sections. Qu Talus (Holocene) - Angular pebble- to boulder-sized rocks; as mapped, may include PQt
- some colluvium. Maximum thickness about 33 feet (10 m). Qc Colluvium (Holocene) - Boulders in a silt and sand matrix; locally mostly silt Massive to crudely bedded. Thickness 3 to 7 feet (1-2 m).
- Alluvium (Holocene) Boulder to pebble gravel, sand, silt, and clay deposited in channels and flood plains of streams. Thickness up to 10 feet (3 m).
- Alluvial-fan and debris-fan deposits (Holocene and Pleistocene) Gravel, sand, and silt; locally bouldery. Crudely bedded to nonbedded and poorly sorted. Maximum
- thickness probably 33 feet (10 m). Landslide deposits (Holocene and Pleistocene) - Poorly sorted; particle size ranges from clay to blocks, depending on material involved in sliding; includes mudflow,
- debris-avalanche, and slump deposits. Terrace gravels (Holocene and Pleistocene) - Pebble and cobble gravel, sand, and silt occurring a few to several tens of meters above modern flood plains. In valleys that have more than on terrace level, terraces are numbered Qtg<sub>1</sub>, Qtg<sub>2</sub>, Qtg<sub>3</sub>, and Qtg, from lowest to highest. Some deposits probably include glacial outwash. Generally a few meters thick; maximum thickness about 130 feet (40 m) in Kamas
- Qoa Older alluvium (Pleistocene) Gravel, silty gravel, and sandy silt in dissected alluvial fans and alluvium. Includes local marsh deposits.
- Qtp Till of Pinedale age (Pleistocene) Poorly sorted bouldery till that forms prominent moraines. As mapped, may include some colluvium, talus, and landslide debris. A few meters thick except in moraines where maximum thickness is 590 feet (180 m).
- Outwash deposits of Pinedale age (Pleistocene) Poorly sorted gravel and sand. Mapped along Weber and Provo Rivers adjacent to the Uinta Mountains. Maximum thickness probably more than 33 feet (10 m).
- Qto Older till (Pleistocene) Poorly sorted bouldery till having subdued morainal topographic expression and found downvalley from or topographically higher than till of Pinedale age (unit Qtp).
- Older outwash gravel (Pleistocene) Gravel, sand, and silt in a smooth-topped, but dissected, deposit on Beaver Creek in southeastern part of study area. Maximum
- thickness probably about 33 feet (10 m). Qof Older alluvial-fan and debris-fan deposits (Pleistocene) - Poorly sorted gravel, sand, and silt; locally bouldery. Crudely bedded to nonbedded. Deposits occur above
- present drainage and are inactive. Maximum thickness about 33 feet (10 m). Pediment gravel (Pleistocene) - Boulder, cobble, and pebble gravel in a sand and silt matrix. Maximum thickness a few feet.
- QTg Gravel (Pleistocene or Pliocene) Unconsolidated pebble, cobble, and boulder gravel near northeast corner of study area. Apparently gravel is a lag concentrate from underlying conglomerate (unit Toc). Maximum thickness about 100 feet (31 m).
- Tlam Lamproite (Miocene) Phenocrysts of phlogopite and, locally, of olivine in matrix of sanidine and diopside. Near Whites Creek northwest of Unita Mountains,
- phlogopite has K-Ar age of 13.5 Ma (Best and others 1968). TIp Porphyritic latite (Oligocene) - Dark- to light-greenish-gray latite containing abundant phenocrysts of plagioclase, hornblende, and biotite and rare phenocrysts of pyroxene. Intrudes the Keetley Volcanics. K-Ar hornblende age from Indian

Hollow plug is about 37.0 Ma (Bromfield and others, 1977).

- Keetley Volcanics (Oligocene and Eocene?) Intrusive and flow rock, breccia, lahar, and tuff, as well as volcaniclastic and nonvolcanic sandstone and conglomerate. Intrusive rocks, flows, and breccias range from black, red, brown to light gray. All the volcanic rocks contain phenocrysts of plagioclase and hornblende, may contain clinopyroxene, and a few contain biotite: all phenocrysts are in a microcystalline to glassy groundmass. Andesite and rhyodacite by field classification, but a few chemical data indicate that the rocks range in composition from trachyandesite and latite to silica-poor rhyodacite (Bromfield and others, 1977). K-Ar ages of biotite and hornblende range from 33.6 to 37.5 Ma (Crittenden and others, 1973; Bromfield and others, 1977). Thickness exceeds 1,600 feet (488 m).
- Tkb Light-gray to gray lahar, flow breccia, and tuff Proportion of tuff increases with distance from volcanic centers. Sandstone and conglomerate composed of volcanic clasts occur distal to volcanic centers. Zircon fission-track age of 35.3 Ma and biotite K-Ar age of 37.5 Ma (Crittenden and others, 1973; Bromfield and others, 1977). Thickness exceeds 1,600 feet (488 m).
- Tki Intrusive rock and breccia May include some extrusive rock.
- Flow rock and breccia

**PROTEROZOIC** 

- Tuff Interbedded light-yellow and yellowish-gray, fine-grained tuff, lapilli tuff, volcanic gravel, and thin lahar deposits. Interbedded and intertonguing upwards into coarse breccia of unit Tkb. Contains early Oligocene vertebrates near Peoa (Nelson, 1972). Thickness as much as 820 feet (250 m).
- Tn Norwood Tuff (Oligocene and Eocene) In northeastern part of study area, unit contains white to light-gray, tuffaceous and calcareous sandstone and siltstone, lenses of pebble conglomerate, and scattered beds of tuff. Radiometric dates from samples collected about 2,000 to 2,300 feet (610-701 m) above the base of the fromation from locations west of study area include: 1) a K-Ar biotite age of 29.6 Ma (R.F. Marvin, U.S. Geological Survey, written commun,. 1982, in Bryant and Nichols, 1988); 2) a zircon-fission track age of 28.6 Ma (W.C. Naeser, U. S. Geological Survey, written commun., 1982, in Bryant, 1990) and 3) a zircon fissiontrack age of 37.4 Ma (Van Horn, 1981).
- Toc Conglomerate (Oligocene and Eocene?) Boulder, cobble, and pebble conglomerate containing fragments of sandstone derived from Mesozoic and upper Paleozoic formations; clasts of Nugget Sandstone (unit Jn) are conspicuous. Contains a few lahars and beds of tuff and volcanic gravel. Locally rich in clasts of volcanic rock in northeastern part of study area. Maximum thickness about 985 feet (300 m).
- Lamproite (Eocene) Dikes, plugs, and flows containing phenocrysts of phlogopite and diopside in a groundmass of phlogopite, diopside, analcite, and glass. Coarser grained varieties also have sanidine and amphibole. At Moon Canyon on southwest margin of Uinta Mountains, phlogopite from intrusive rock has a K-Ar age of 40.9 Ma, and phlogopite from flow has an age of 37.9 Ma (Best and others,
  - Fowkes Formation (Eocene) Found only in northeastern part of study area.
- Bulldog Hollow Member White to light-brown tuff, sandy tuff, and tuffaceous
- Wasatch Formation (Eocene and Paleocene) Moderate-red, grayish-red, pale-red, reddish-brown, and gray sandstone, conglomerate, siltstone, and claystone; contains scattered, thin, lenticular beds of light-purplish-gray to light-gray, nonmarine limestone. Conglomerate clasts range from pebble to boulder size and have a varied lithology from diverse sources. Stratigraphic thickness about 3,940 feet (1,200 m) north of the Uinta Mountains. In Chalk Creek area, yellowish-grayweathering conglomerate forms a basal unit as much as 330 feet (101 m) thick overlain by a sequence of variegated sandstone and siltstone. This sandstone and siltstone layer is overlain by or interfingers with coarse conglomerate to the south, which was derived from Paleozoic and Precambrian rocks of the Uinta uplift. Palynomorphs indicate the lower 660 to 980 feet (201-299 m) is late Paleocene (Jacobson and Nichols, 1982; Lamerson, 1982; Bryant, 1990).
- Wasatch Formation, conglomerate dominant

Maastrichtian age (Bryant, 1990).

- Hams Fork Member of Evanston Formation (Upper Creataceous) Medium- to lightgray and greenish-gray siltstone and claystone, light-gray to yellowish-gray and brownish-gray sandstone, and basal pebble to cobble, locally boulder conglomerate. Sandstone contains reddish-brown-weathering concretions in places. Conglomerate contains clasts of Precambrian quartzite derived from Willard thrust sheet to the north of the study area. Thickest section is about 2,620 feet (799 m) on northeast side of Cherry Canyon, southeast of Wansip in the central part of the map area. Pollen indicate a late Campanian to early
- Adaville and Hilliard Formations (Upper Cretaceous) Yellowish-gray to white, thinly laminated, cross-bedded sandstone containing some scattered pebbles and beds of pebble conglomerate; clasts are predominantly sandstone, siliceous shale of the Aspen Shale, and chert. A few beds have reddish-brown-weathering concretions as much as 5 cm in diameter. Also includes gray siltstone, claystone, and marine shale. Unit mapped only in the lower plate of the Absaroka trust in the Crandall Canyon-Neil Creek area. Probably at least 4,920 feet (1,500 m) thick, but estimated thickness is complicated by structural complexities.
- Echo Canyon Conglomerate (Upper Creataceous) Pale-red to yellowish-gray to light-yellowish-brown cobble conglomerate containing discontinuous lenses of coarse-grained sandstone. Contains very sparse intervals of gray sandstone, siltstone, and claystone, some of which contain pollen of Coniacian to Santonian age. Clasts in conglomerate are predominantly sandstone derived from Mesozoic or upper Paleozoic rocks. Limestone and chert clasts are sparse. Boulders are as much as 10 feet (3 m) in diameter in lower part. Thickness about 2,652 feet
- Henefer Formation (Upper Creataceous) Light-gray clay, siltstone, sandstone, and conglomerate; red siltstone and clay; and gray calcareous siltstone containing a few thin lenses of coal. Beds and lenses of pebble and cobble conglomerate numerous near top. Thickness about 2,625 feet (800 m).
- Frontier Formation (Upper Cretaceous)
- upper member Light-yellowish gray marine sandstone, gray marine shale, gray to brown siltstone and silty shale, and coal. Conglomerate, which occurs at the base of the unit as a bed 20 to 98 feet (6-30 m) thick in the Coalville area, contains rounded pebbles and cobbles of sandstone and limestone. Abundant conglomeratic beds in northwestern part of study area . In Coaly contains middle Coniacian fauna 1,080 feet (329 m) above base and at top (Ryer, 1976). Thickness 2,620-3,610 feet (799-1,101 m) in Coalville area.
- Oyster Ridge Sandstone Member Light-yellow to gray marine sandstone and pebbly sandstone locally overlain by nonmarine sandstone, siltstone, and silty shale. Thickness 195 to 330 feet (60-101 m).

- lower member Light- to dark-gray marine shale, sandstone, conglomeratic sandstone, and silty shale, coal and gray, light red, grayish-red, and green claystone. Contains earlier Turonian fossils about 3,280 feet (1,000 m) above base and early middle Turonian fossils in the upper 788 feet (240 m) in Coalville area (Ryer, 1976). Thickness 4,495 feet (1,370 m) in Coalville area.
- Ksj Sage Junction Formation (Lower Cretaceous) Light-gray and pinkish-gray mudstone; yellowish-gray, light-brown, and gray siltstone and fine-grained sandstone; and interbeds of white, green and pink porcellanite. Exposed only near and in northeastern part of study area as incomplete sections.
- Kc Cokeville Formation (Lower Cretaceous) Interbedded dark-gray, carbonaceous, shale, mudstone, and siltstone, yellowish-gray-weathering sandstone, and very fossiliferous gray to tan limestone and coquina. Occurs only in upper Chalk Creek
- area. About 1,640 feet (500 m) thick. Ktf Thomas Fork Formation (Lower Cretaceous) - Pale-red and reddish-brown mudstone and gray and yellowish-gray to tan limestone and coquina. Occurs only in upper Chalk Creek area where incomplete section is at least 800 feet (244 m) thick.
- Ka Aspen Shale (Lower Cretaceous) Dark-gray siliceous shale and silty shale containing abundant scales of teleost fish. Maximum thickness about 520 feet (159 m) north of Peoa; thins to west and north.

## Kelvin Formation (Lower Cretaceous)

- upper member Yellowish-gray, grayish-red, and light- to moderate-red sandstone; gray, reddish-brown, and grayish-red siltstone and claystone; and conglomerate Conglomerate contains pebbles and cobbles of sandstone, siltstone, and minor amounts of limestone. About 4,260 feet (1,299 m) thick; thins to west and south.
- Parleys Member Light- to pale-gray limestone associated with pale-lavender-gray siltstone containing limestone nodules: reddish-brown siltstone pale-brown to pale-reddish-brown sandstone, and conglomerate. About 160 feet (49 m) thick.
- Jms | Morrison and Stump Formations (Upper and Midle Jurassic) Shown in subsurface on cross sections I-I' through K-K', plate 3.
- Morrison Formation (Upper Jurassic) White to grayish-purple sandstone, moderatered to grayish-purple siltstone, moderate-reddish-orange silty sandstone, and gray limestone. A few beds of chert-pebble conglomerate near top. Thickness 260 feet
- Stump Formation (Upper and Middle Jurassic) Pale-red and yellow shale and sandstone and gray to yellowish-gray sandstone; greenish-gray, glauconitic limestone at base. Locally contains pelecypods. Thickness 200 feet (61 m).
- Jp Preuss Sandstone (Middle Jurassic) Reddish-brown, grayish-red, and light- to moderate-red silty sandstone, sandstone, and silty shale. Contains anhydrite and salt in the subsurface in the Chalk Creek area and west of Echo Reservior (Lamerson, 1982). About 980 feet (298 m) thick, but locally has been thickened due to deformation and flowage of salt, anhydrite, and associated shales.
- Jt Twin Creek Limestone, undivided (Middle Jurassic) Thin- to medium-bedded, gray, light-gray, and purplish-gray limestone and some beds of grayish-red to brown siltstone and sandstone. Locally fossiliferous. Thickness about 1,379 feet (420 m) near Peoa. Undivided in subsurface parts of cross sections H-H' through K-K' (plate 3) that are unconnected to surface exposures.
- Giraffe Creek Member Pale greenish-gray sandstone interbedded with pale green to yellowish-tan calcareous siltstone. About 82 feet (25 m) thick.
- Leeds Creek Member Pale greenish-gray to yellowish-tan calcareous siltstone to clayey micrite. About 776 feet (237 m) thick.
- Watton Canyon Member Pale bluish-gray weathering, medium to dark gray, clayey micrite with well-defined bedding. Thickness 220 to 400 feet (67 - 122 m)
- Boundary Ridge Member Tan to reddish-brown calcareous shale. About 107 feet (33 m) thick. Rich and Sliderock Members, undivided - Dark to medium-gray, clayey micrite, with
- one or two resistant, oolitic grainstone beds in Sliderock Member. Thickness 17
- Gypsum Springs Member Reddish-orange, fine-grained sandstone and gypsiferous shale. Thickness 22 feet (7 m).
- Jn Nugget Sandstone (Lower Jurassic) Pale-grayish-orange, fine-grained sandstone, and white quartz sandstone. Cross-bedded in upper part, planar bedded in lower part. Thickness 920 to 1,250 feet (280-381 m) near Peoa.

## Ankareh Formation (Upper and Lower Triassic)

- Ra Ankareh Formation, undivided shown only on cross sections.
- Upper member (Upper Triassic) Moderate-red, grayish-red, and grayish-purple mudstone and fine-grained sandstone. Thickness about 800 feet (244 m) in western Uinta Mountains.
- Gartra Member (Upper Triassic) White to pale-purple, massive, cross-bedded, coarse-grained to pebbly quartzite. Thickness about 800 feet (244 m) in western
- Mahogany Member (Lower Triassic) Purplish-gray and pale-red sandstone, mudstone, and a few thin limestone beds. Thickness 400 feet (122 m) on northwest flank of Uinta Mountains.
- Thaynes Limestone (Lower Triassic) Light-gray, thin- to thick-bedded limestone and brownish-gray siltstone containing beds of light-gray sandstone, pale-red silty limestone, light-gray shaly limestone, and dark-greenish-gray siltstone and shale Locally contains pelecypods, gastropods, and ammonites. Thickness 650 to 1,175
- Noodside Formation (Lower Triassic) Grayish-red, grayish-purple, reddish-brown, and moderate-red shale, siltstone, and fine-grained sandstone; thin white limestone beds; and grayish-red siltstone. Locally, a few tens of meters of green or greenish-gray shale and siltstone at the base. Thickness 700 feet (213 m).
- Ppc Park City Formation and related rocks (Permian) Fossiliferous and cherty, gray to pinkish-gray limestone, calcareous siltstone, and cherty sandstone; near middle of unit is a dark-gray, phosphatic shale which is about 98 feet (30 m) thick (Meade Peak Phosphatic Shale Member of Phosphoria Formation). Thickness 775 to 950 feet (236-290 m).
- Pw Weber Sandstone (Pennsylvanian) Pale-yellowish-gray to white, cross-bedded, quartzitic and calcareous sandstone containing a few beds of light-gray to white limestone, and dolomite. Thickness about 1,730 to 2,600 feet (527 - 792 m) on
- Pm Morgan Formation (Middle Pennsylvanian) Grayish-red calcareous siltstone and silty limestone, light-greenish-gray siltstone, grayish-red and reddish-brown sandstone, gray fossiliferous limestone containing gray, yellowish-gray, reddish-brown, and pinkish-orange chert, and white to light-gray sandstone. About 200 to 500 feet (61 -
- Round Valley Limestone (Lower Pennsylvanian) Light-gray-weathering, gray to darkgray, fossiliferous limestone containing gray and reddish-gray chert and interbeds of gray and light-green shale and siltstone, grayish-red silty shale, and sandstone and sandy limestone. Pale-reddish-orange silicified fossils are characteristic. Thickness about 170 to 700 feet (52-213 m).
- Doughnut Formation (Upper Mississippian) Medium-gray, thin-bedded limestone containing pods of dark-gray to black chert and abundant fossils; a 33- to 98-footthick (10-30 m) zone of black, greenish, or locally reddish shale at the base contains thin beds of greenish-gray to rusty-weathering, silty limestone, black shale containing thin beds of dark-gray limestone, and rusty-weathering sandstone. Thickness about 175 to 650 feet (53-198 m).
- Mh Humbug Formation (Upper Mississippian) Medium- to dark-gray limestone, dolomite, and limestone breccia containing beds of reddish-brown- to yellowish-gray-brownweathering sandstone and rare interbeds of red siltstone. Thickness 420 to 1,500 feet (128-457 m).
- MDmu Madison Limestone (Upper and Lower Mississippian) and Upper Devonian rocks -Dark-gray, fine- to coarse-grained dolomite and limestone locally containing abundant gray and white chert. Dark- to light-gray, thin- to medium-bedded, fossiliferous limestone near base. Thickness 325 to 1,250 feet (99-381 m).
- Ct Tintic Quartzite (Middle and Lower Cambrian) Medium- to thick-bedded, fine- to coarse-grained, white, pale-yellowish-gray, and pale-reddish-brown quartzite; conglomeratic beds in lower 328 feet (100 m) thick locally are preserved below pre-Late Devonian unconformity around Uinta Mountains.
  - Uinta Mountain Group (Middle Proterozoic)
- Red Pine Shale Grayish-black to olive-drab siltstone and shale, and thin, discontinous quartzite and arkose beds. About 2,950 feet (900 m) thick on South Fork of Weber River. Whole-rock Rb-Sr age of 952 Ma (Crittenden and Peterman,
- Hades Pass unit of Wallace (1972; Sanderson, 1984) Pale-red, grayish-red, palereddish-brown, light-gray, and yellowish-gray quartz sandstone, arkose, and shale; thick, moderate-red, lenticular shale beds on north flank of the Uinta Mountains and thin, discontinuous shale beds on south flank. Shale(s) shown where thick and continous. About 5,900 feet (1,800 m) thick.
- Mount Watson unit of Wallace (1972; Sanderson, 1984) Thick-bedded, yellowishgray to grayish-white, lithic arkose and fine-grained quartzite containing thin, lenticular, olive-drab shale and siltstone beds. About 3,280 feet (1,000 m) thick.